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HDG: July 6 2007

Higgs Jet and Met Resolution

Task Force Update

- *Separate talk on improving the Missing Et Resolution*
- *Tutorial and Tools for Jet Resolution Studies*
- *Some Initial Comparisons*
- *Interfacing to ntuples*
- *Future Plans*
- *Summary*

Met Model

See talk by Sasha Pronko

Wednesday, June 20, 2007 “higgs jet met task force jesr”

Existing methods:

CDF 8719 (MetSpecial): $S/B_{DY} = 0.1$

CDF 8700 (Multivariate Techniques): $S/B_{DY} = 0.05$

Looked at using the MetModel in the $H \rightarrow WW$ analysis

MetModel: $S/B = 0.3$

MetSpecial > 25: $S/B = 0.09$

→ *Improved Signal to Background separation*

→ *Looks promising even without any fine tuning and optimization*

Tutorial and Tools for Jet Resolution Studies

Some features...

- Example of how to use the StNtuple

Read StNtuple from a file

```
chain->AddFile("/data/ncdf76/b/higgs/bhgs1c/stntuple/bc028202.0001hgs1",
    TChain::kBigNumber);
```

Read StNtuple from a remote server

Samples generated with range of ZMass (light quarks and $b\bar{b}$)

```
chain->AddFile("root://fcdfdata120.fnal.gov//export/data8/qcd/bhatti/zmass/zmass.0009.stn",
    TChain::kBigNumber);
```

- Redo jet clustering “*Clustering-on-the-fly*” from Ken Hatakeyama

→ *Parton, Hadron, JetClu, MidPoint, KtClus*

- Apply different correction algorithms all in one job

→ *L5, H1, Particle Flow (PFA), and PFA + Neural Net*

- Framework to validate and study performance
 - Comparisons to hadron/parton level jets
 - Make direct comparisons between the different algorithms
 - Produce output ntuple
Subset of jet variables making it easier to study the performance
 - Access output ntuple and generate plots
Example macros to produce plots

- Documentation at:

<http://www-cdf.fnal.gov/internal/physics/HiggsJetMet/>

Under the link

“Framework for Jet Resolution Studies”

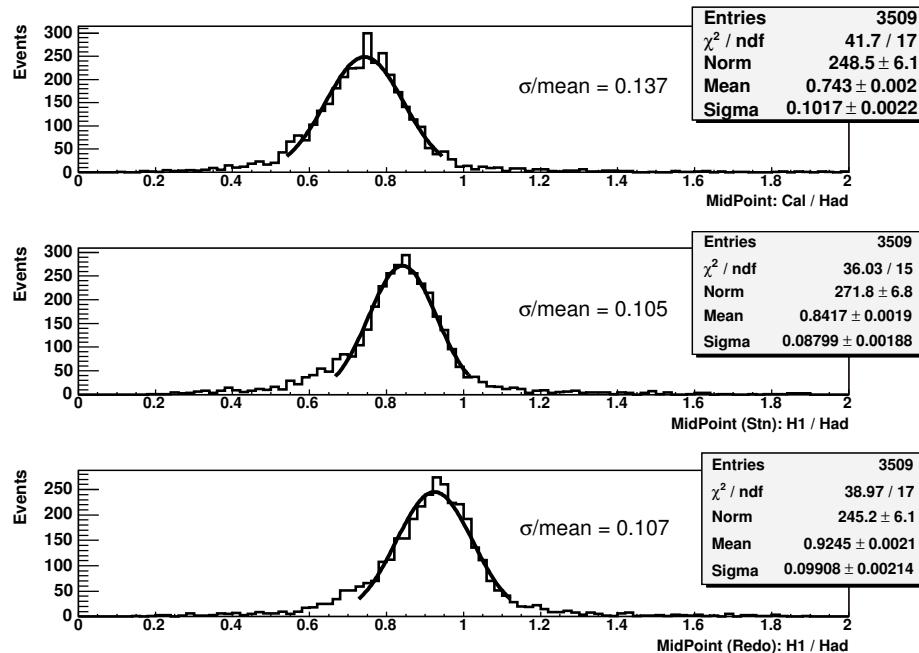
Some Observations...

StNtuples are not all produced with the same jet collections

Missing: *Parton/Hadron level jets, H1-JetClu jets*

- *Very useful to be able to recluster jets “on the fly” in order to construct the missing collections*
- *Useful to be able to apply corrections at the ntuple level...*

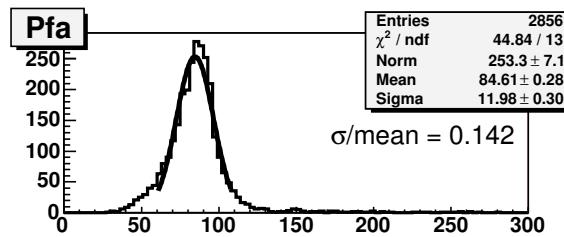
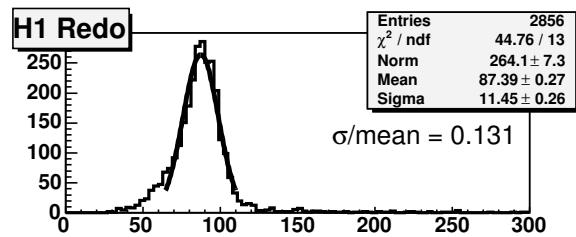
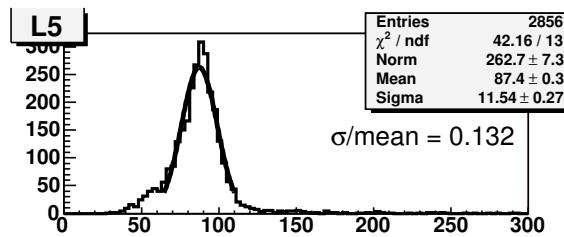
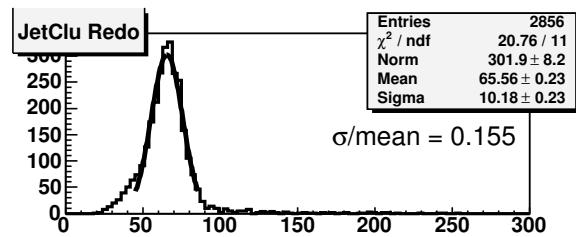
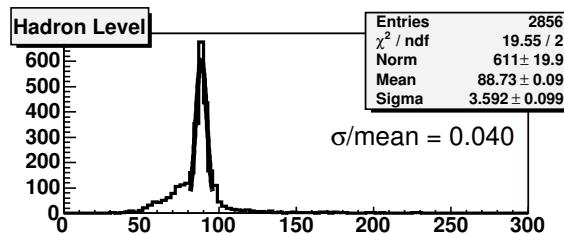
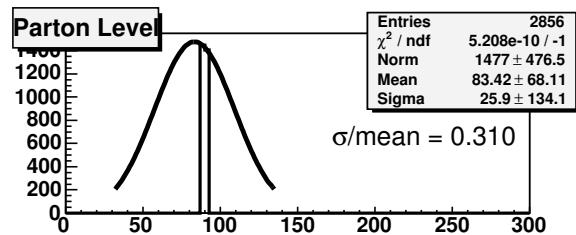
See better results when applying H1 correction to the StNtuple



Once you apply the correction at the AC++ level you are stuck with what you get...

More flexible to be able to apply the correction at the ntuple level

Dijet Mass of the ZMASS=90 (light quarks) MC sample



JetClu cone 0.7

Raw

L5

H1

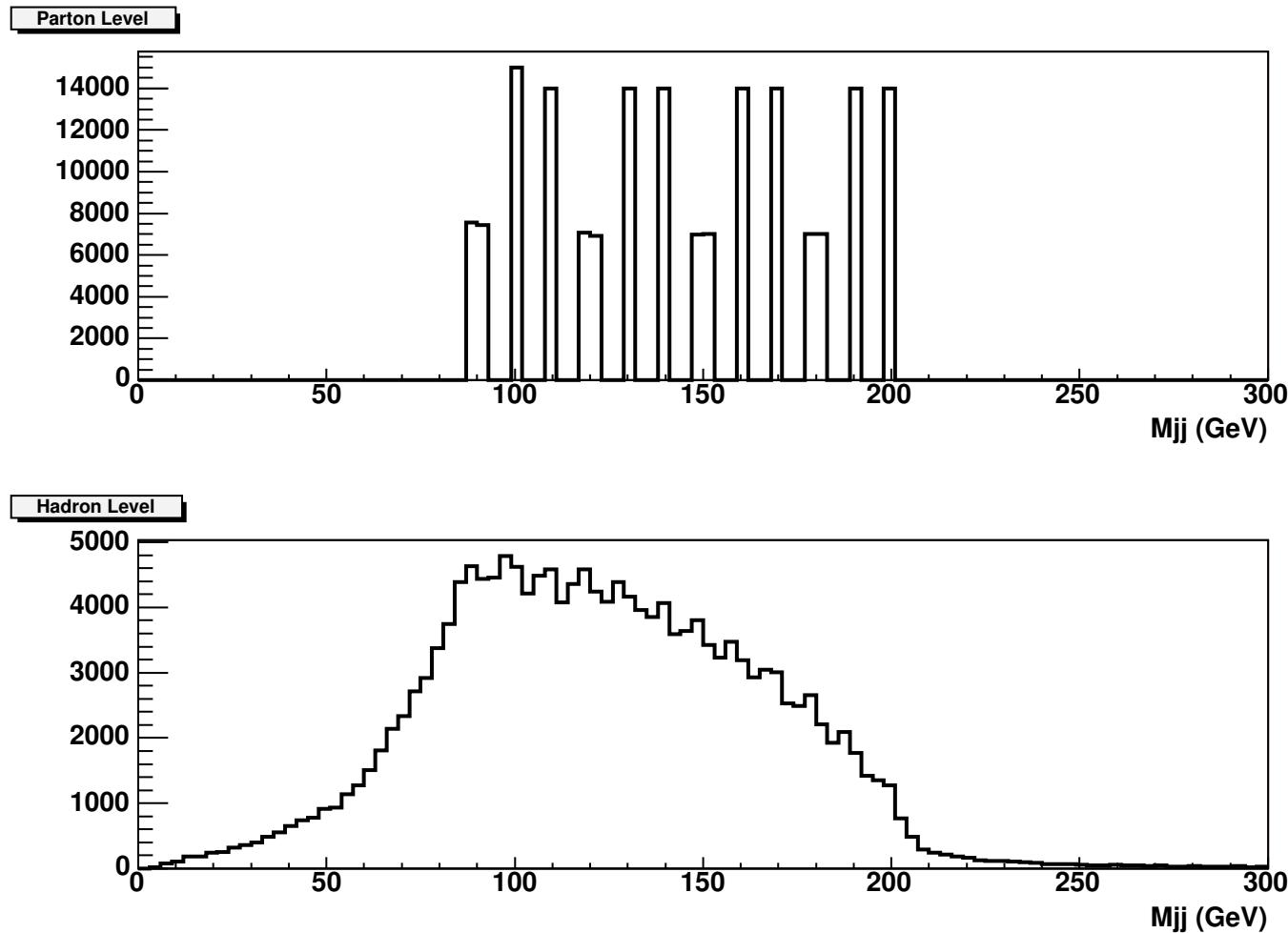
Pfa

What is the best metric to look at?

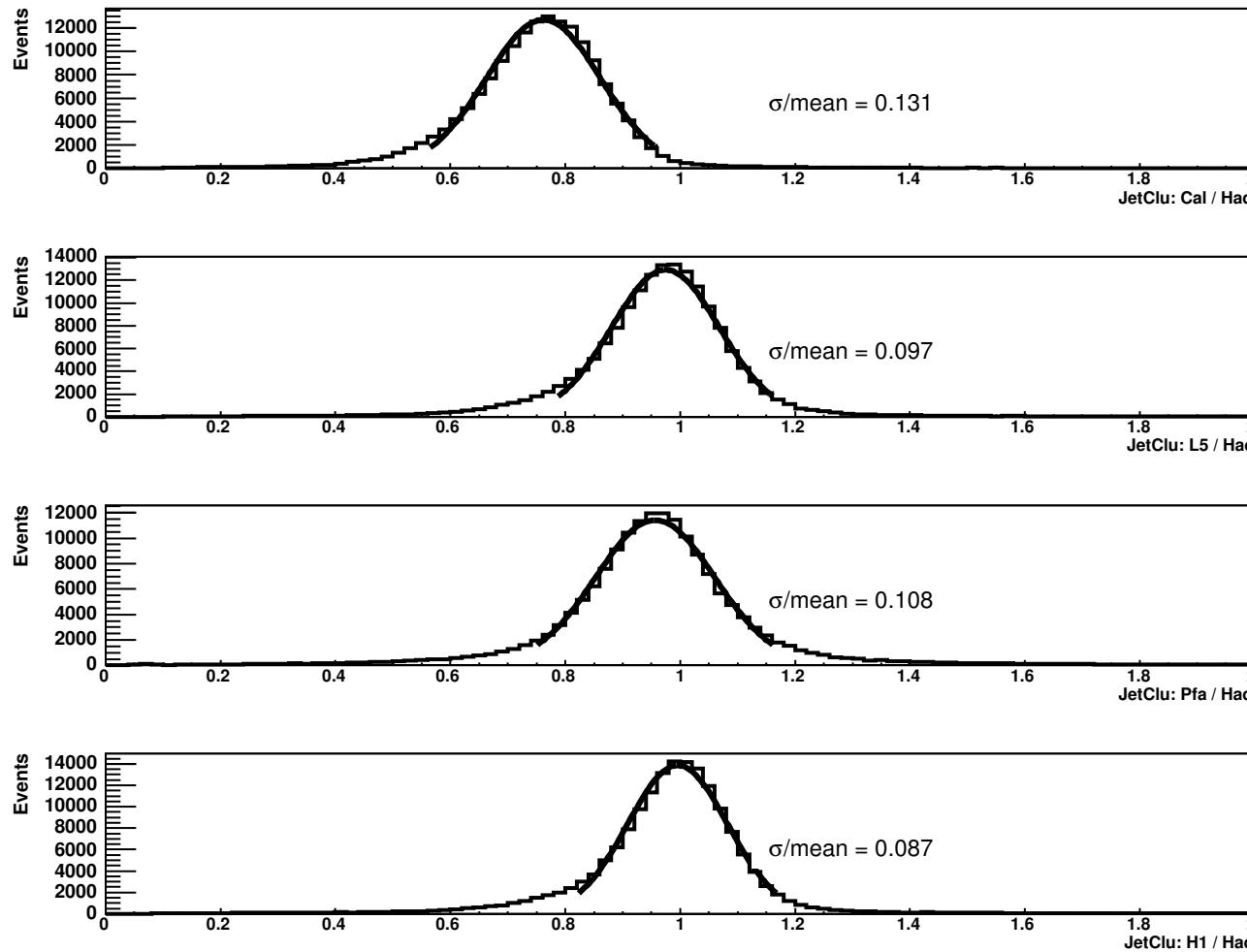
Want to compare the reconstructed dijet mass to the hadron level dijet mass

$$\frac{\sigma (\text{Reco}(M_{jj}) / \text{Hadron}(M_{jj}))}{\langle \text{Reco}(M_{jj}) / \text{Hadron}(M_{jj}) \rangle}$$

Used $Z \rightarrow q\bar{q}, b\bar{b}$ with Z mass ranging from 90 to 200 GeV.



Reco(M_{jj}) / Hadron(M_{jj}) for $Z \rightarrow b\bar{b}$ (ZMass 90 - 200 GeV)

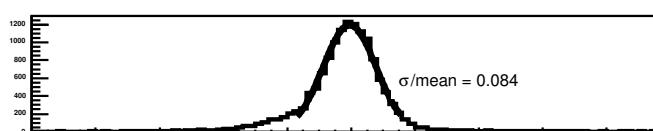
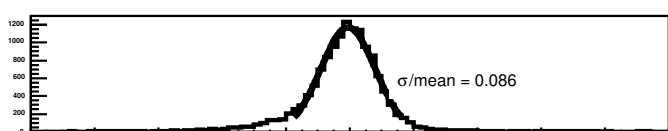
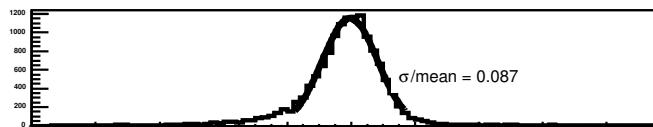
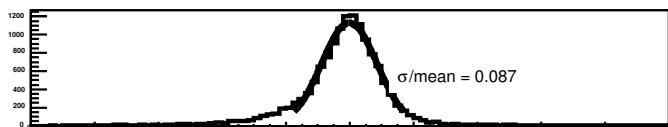
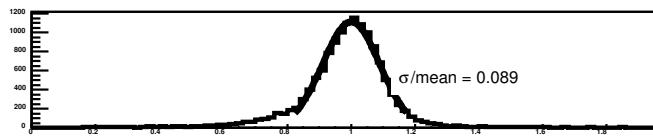
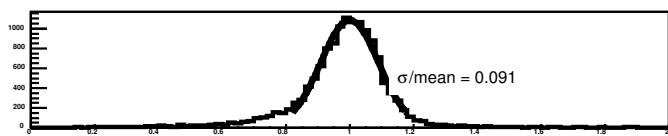
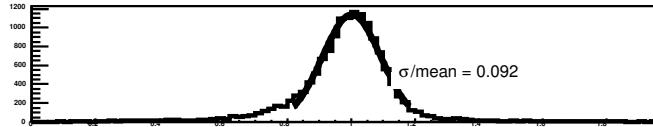
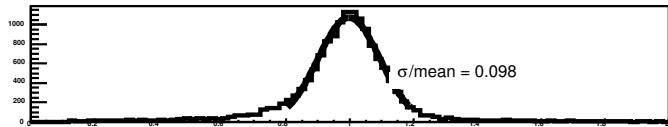


Fit ratio using *gaussFit.C* function provided in tutorial.

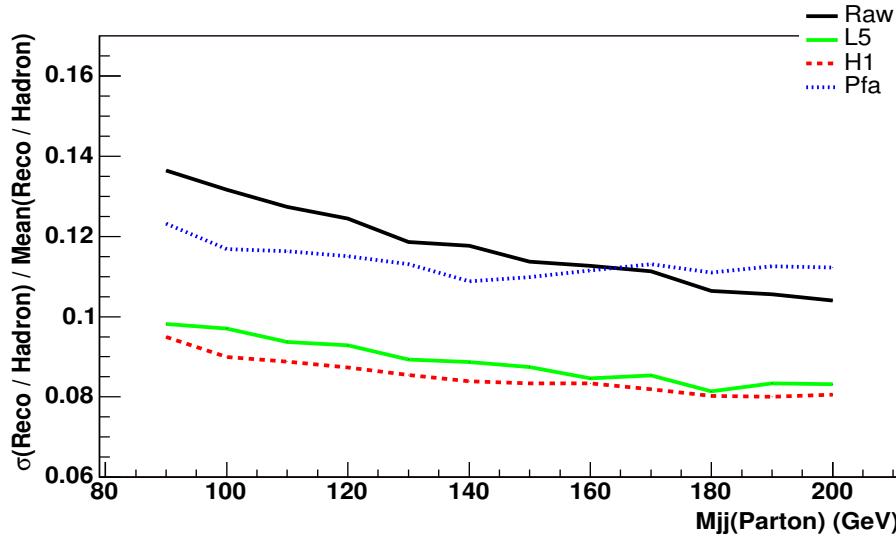
H1 gives very good results “out of the box”: $\sigma/\text{mean} = 0.087$

Want to look at resolution as a function of the Dijet Mass....

σ/mean in different M_{jj} bins ranging from 90 - 200 GeV

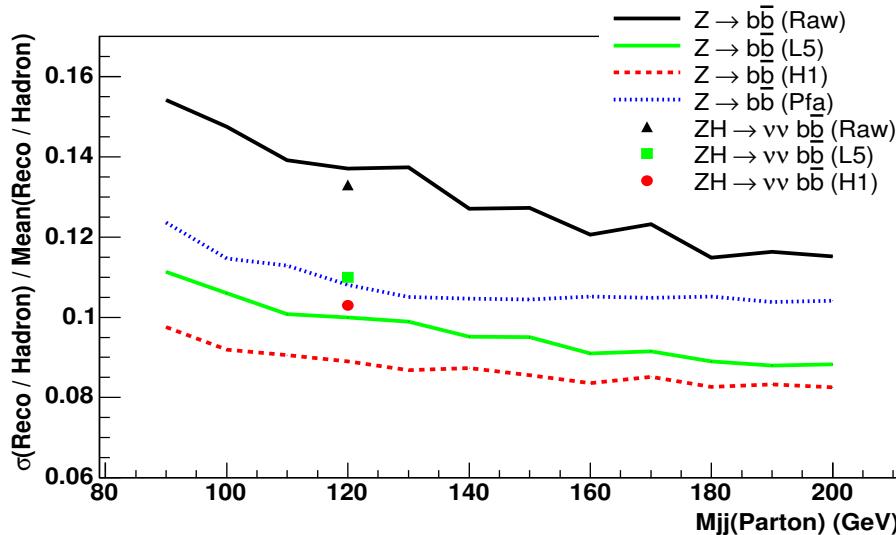


All η - light jets

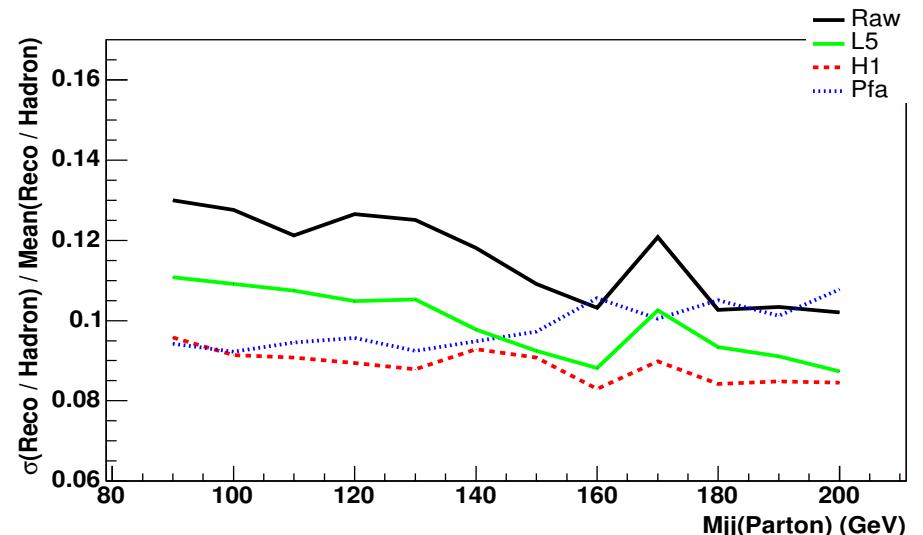


Dijet Mass Resolution for different input samples and different Jet Correction algorithms...

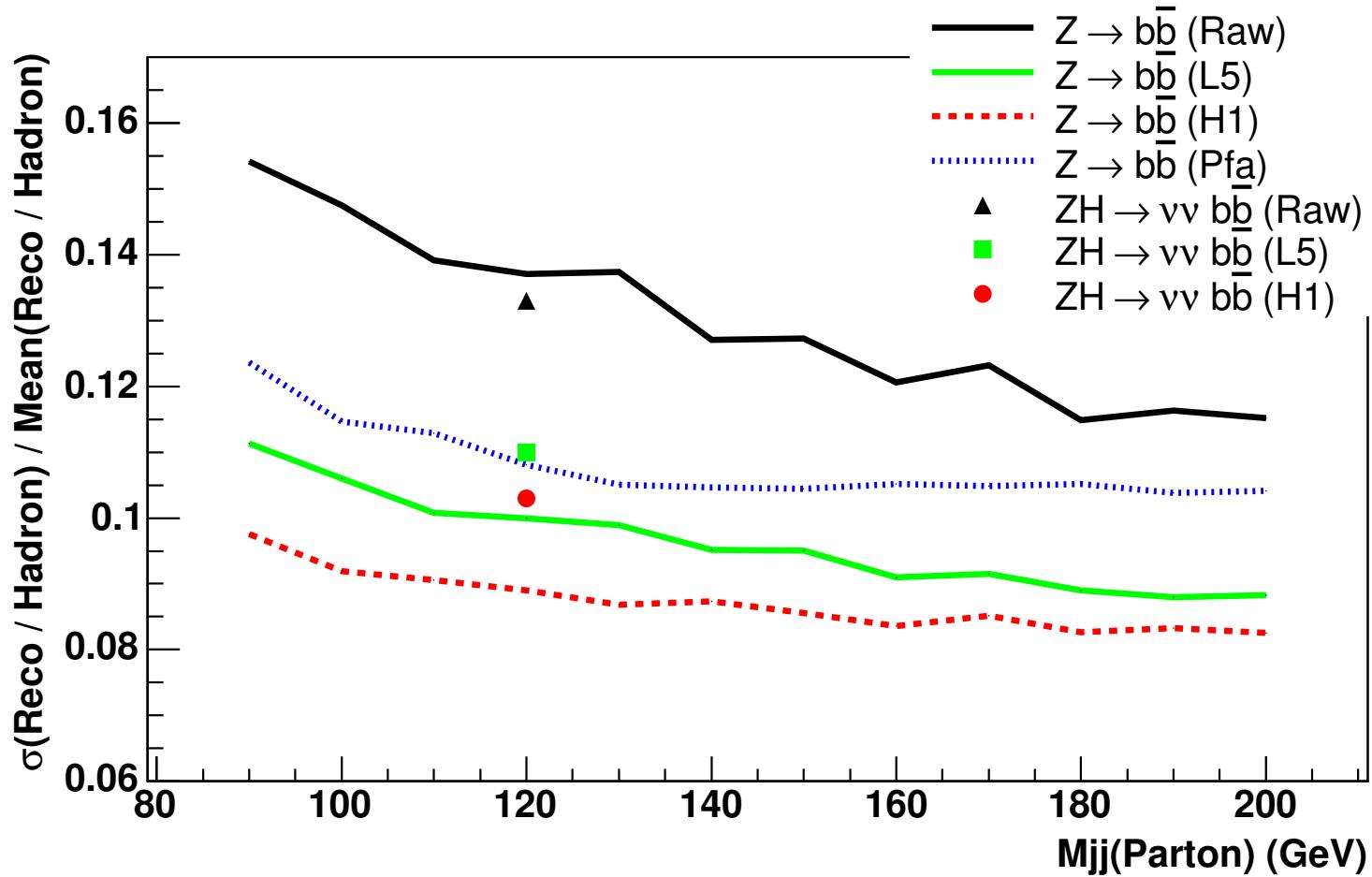
All η - b jets



Central ($|\eta_{Det}| < 0.7$) - b jets



- H1 has the best performance
- Does better than L5 over the *entire* mass range
- Improvement gain for b -jets is greater than for light jets



PFA Status

Need expert to validate tutorial and establish “Version 0”

Total Jet Energy is the sum of parts, using:

```
P4PfaAll = 1.05 * P4PfaTrkJet + P4PfaEmEstimJet + 1.20 * P4PfaNeutralEstimJet;
```

- *May need to tune scale factors*
- *Determine dependence on Jet E_T*

See that for central jets PFA is comparable to H1 at low mass
but gets worse at higher mass

- *This is an area we can use some help with...*

Tools to do these studies are available...

From Ken, Anton and Junji...

Interface to StNtuple and TopNtuple

Want to provide a ntuple independent interface to the same code

→ *Call the same code when using different ntuples...*

Ray initiated a meeting to specify interface

Ray, Charles, Ken and Anton...

Define ntuple independent interface

Add missing information to TopNtuple

Longer term support issues, version control...

Need to have a well defined starting point (Version 0) that is reproducible

Same structure and also be used for the MetModel...

Future Plans

Encourage people to use H1 corrections in their analysis

- *Available now for the STNtuple...*
- *Already being used in other analyses and is the most established correction procedure*

Provide H1 corrections in TOPNtuple

- *Need to make it more generally available*
- *Requires adding additional information to ntuple*

Develop ntuple independent interface

- *Provide interface for Met Correction*

Continue development of PFA algorithm

- *Understand M_{jj} results*
- *Need additional help with this*

Summary

Tutorial largely based on Ken's “clustering-on-the-fly” example

Not all Jet Collections and Corrected Jets available in the ntuple

→ *Useful to apply corrections and redo clustering from the ntuple*

→ *In order to take advantage of the best performing version of the H1 algorithm you need to apply it to the ntuple*

Can run H1 from StNtuples, TopNtuple does not have the needed information...

Provide a ntuple independent interface (TopNtuple and StNtuple)

→ *Need to have a reproducible starting point*

→ *Need to put code in cvs and make sure we track versions*

Need to understand PFA results for the dijet mass resolution...